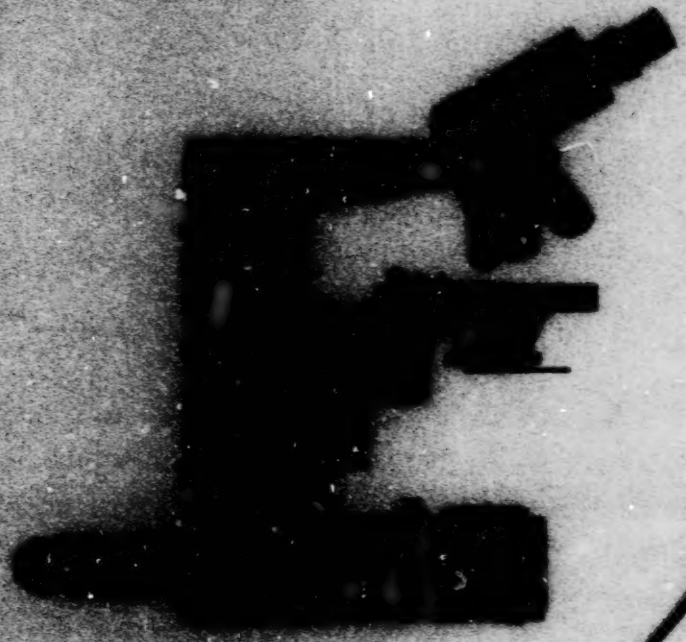
Dairy Laboratory Quality Testing Summary



1983 Annual Report

MANITOBA
AGRICULTURE
Animal Industry Branch
Dairy Section

F O R E W O R D

The following report contains the annual summary of test results of the Dairy Laboratory of the Animal Industry Branch, Manitoba Agriculture. The Laboratory is located at the Agricultural Services Complex, University of Manitoba, Winnipeg.

Samples analysed at the laboratory continue to provide information on dairy products and milk samples for quality control, health requirements, payment to producers, milk recording information and extension activities within the dairy industry. The analyses performed to provide this information cover a variety of test procedures. The 1983 data is summarized in the tables included in this report.

Some of the main testing features of the dairy laboratory include: fat, protein, and lactose determinations on producer herd samples as well as on cow samples for centrally tested D.H.I.A. and Owner Sampler programs; bacterial plate counts, antibiotic and added water tests on producer and finished product samples; monitoring of finished dairy products to ensure the absence of pathogenic organisms.

Due to the integration of the D.H.I.A. program into Central testing and the significant growth in this program, a considerable increase in work load was experienced in the milk composition unit of the Dairy Laboratory. This integration was completed in 1980. To handle this additional sample load a second MilkoScan 203 was put in line. Information on Butterfat-protein inversions continues to be available to extension personnel as an aid in correcting the problems of feeding and herd management.

All tests for payment purposes for the Manitoba Milk Producers' Marketing Board continue to be done weekly by the MilkoScan 203, on fresh milk samples. These weekly test results are transmitted to the Marketing Board via computer interchange, with the butterfat results used to determine the value of milk shipments based on a butterfat differential. Protein and lactose results continue to be entered in the computer storage tape for possible future use.

Two Hewlett Packard 85 instrument controllers have now been interfaced with both MilkoScan 203's. This has practically eliminated the manual transfer of data. All producer test data from the MilkoScan continue to be automatically recorded on tape and then transferred to the Milk Marketing Board computer via telephone line.

LABORATORY STAFF

D.M. Macaulay, BSA., MSc	Dairy Laboratory Specialist
Lynne Macaulay	Supervisor, Milk Composition Lab.
Mary Anne Kuebler BSc	Supervisor, Microbiology Lab.
B. Kupskay, BSc, MSc	Technician
Glenna Wentworth, Dip. of Biological Tech.	Technician
Ed P. Taylor	Technician
Tannis Paton, BSc	Technician
Birgit Neilsen, BSA	Technician
On Chan BSc.	Technician

DAIRY LABORATORY FUNCTIONS

The Dairy Laboratory is a central testing facility within the Dairy Section of the Animal Industry Branch, Manitoba Agriculture.

The basic functions of the laboratory are:

1) Testing of raw milk to insure that it meets the quality requirements as outlined in the Dairy Act.

2) Testing of pasteurized dairy products to insure that all safeguards are met and to provide information on keeping quality estimation.

3) Testing of pasteurized dairy products to insure that all composition parameters are maintained.

4) Testing for butterfat and other components as a basis of payment to milk producers.

5) Milk Composition testing for Dairy Herd Improvement Association and Owner Sampler Milk Recording programs.

6) Assistance to field staff and industry in solving quality problems.

SAMPLING

1) The procedure in use for raw milk, involves the aseptic collection of a universal milk sample that can be used for both bacteriological and compositional analyses. Each milk shipper is supplied with sterile "whirl-pak" plastic bags, identified with his name and number. These bags are used for representative sampling by the Bulk Milk Grader at each Bulk Milk pick-up. The milk samples so collected are stored in an ice water container on the truck and then transferred to a refrigerated storage at the dairy plant prior to delivery to the laboratory. All samples are delivered to the dairy laboratory within 48 hours of pick-up and must arrive at a temperature below $5^{o}C$.

2) Sampling and testing of all pasteurized fluid products is done not less than once per week. The products include cottage cheese, sour cream, cream cheese spread, as well as fluid milk products. Butter and cheddar cheese samples for bacteriological examination are taken not less than once per month from all manufacturing plants in the Province.

RAW MILK QUALITY

ARTEK AUTOMATIC COLONY COUNTER

Used for counting of Standard Plate Counts and Plate Loop Counts on raw and pasteurized milk samples.

Plate loop bacteria counts are done for each milk producer once per month to insure that bacteriological standard for acceptable milk of "not more than 75,000 per ml" is maintained. It is generally agreed that if milk has been produced and handled properly there should be no difficulty in maintaining a bacteria count of less than 75,000/ml. In fact, over 85% of the producer samples have counts of less than 50,000 (Table 1). Since most of the bacteria present in raw milk produce enzymes capable of producing defects in the pasteurized product their numbers should be low to insure that the final product is of good quality.

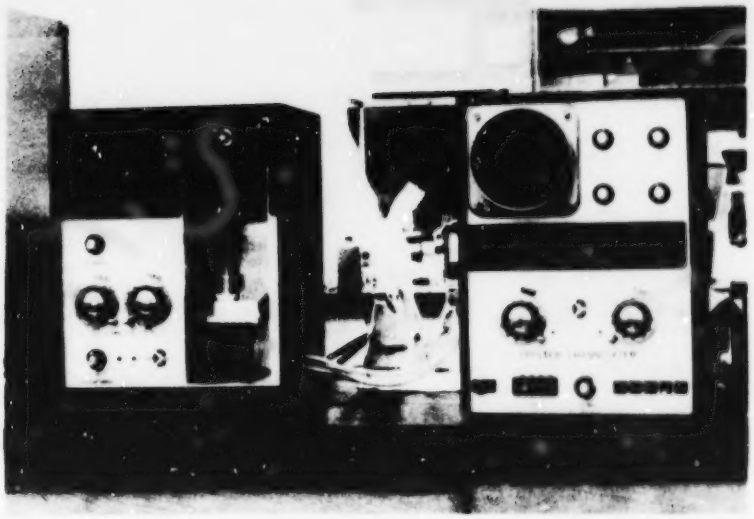
TABLE 1

RAW MILK QUALITY - 1983

PLATE LOOP COUNTS
(counts per ml)

MONTH	PRODUCER SAMPLES	<50,000	PERCENT <50,000	50,000 TO 75,000	PERCENT 50-75,000	<75,000	PERCENT	>75,000	PERCENT >75,000	PLATE LOOP SAMPLES
January	1209	1028	85.0	156	12.9	1132	93.6	77	6.4	1482
February	1211	1070	88.3	101	8.3	1171	96.6	40	3.3	1500
March	1216	1065	87.6	111	9.1	1176	96.7	40	3.3	1472
April	1223	1053	86.1	121	9.9	1174	96.0	49	4.0	1495
May	1217	1001	82.3	121	9.9	1122	92.2	95	7.8	1405
June	1217	1066	87.6	114	9.4	1180	96.9	37	3.0	1593
July	1216	960	78.9	179	14.7	1139	93.7	77	6.3	1634
August	1201	935	78.1	193	16.1	1139	94.8	62	5.2	1531
September	1198	1023	85.4	136	11.4	1162	97.0	36	3.0	1490
October	1194	1087	91.0	76	6.4	1163	97.3	31	2.6	1457
November	1190	1061	89.2	96	8.1	1157	97.2	33	2.8	1446
December	1189	1053	88.6	99	8.3	1153	96.9	36	3.0	1486
YEARLY TOTAL	14,481	12,402	85.6	1503	10.4	13,686	95.8	613	4.2	17,991

SOMATIC CELL COUNTS



COULTER COUNTER AND COULTER CHANNELYZER

The Coulter Counter is used for electronically counting somatic cells in milk. Coulter Channelyzer is used to determine the range of Somatic Cell sizes in the milk sample.

Somatic cell counts are done on all milk producer samples once per month. The cell count is reported on a per ml. basis and includes all "body cells" occurring in the milk such as leukocytes and epithelial cells. (Summarized in Table 2). The main causes for elevated cell counts are mastitis infection and mechanical injury from the milking machine, other "stress" factors and stage of lactation. Associated with elevated cell counts are altered milk composition, flavour defects, decreased milk production, and low yeilds in cheese production. Producers with consistently high cell counts may be given special attention by the Farm Services Staff in an attempt to find the causes for the high cell count. An important first step is to analyze the milking equipment and methods used. When recommended corrections are made in the herd, an aseptic sample is taken from each quarter of every cow, for analysis on the Coulter Counter and Channelyzer. Selected quarter samples, in addition to examination for cell size distribution, are cultured to determine if there is a bacteriological cause for the elevated count.

TABLE 2

SOMATIC CELL COUNTS - 1983

(counts per ml)
(m= million)

MONTH	PRODUCERS TESTED	<500,000	%	500 to 1m	%	1m to 1.4m	%	1.5m or>	%
January	1202	632	52.6	456	37.9	89	7.4	31	2.6
February	1198	686	57.3	426	35.6	61	5.1	25	2.1
March	1193	792	66.4	352	29.5	47	3.9	12	1.0
April	1191	648	54.4	434	36.4	78	6.5	31	2.6
May	1209	716	59.2	405	33.5	72	6.0	16	1.3
June	1187	676	57.0	435	36.6	66	5.6	10	.84
July	1191	514	43.2	522	43.8	122	10.2	33	2.8
August	1193	419	35.2	557	46.6	169	14.2	48	4.0
September	1149	478	41.6	507	44.1	116	10.1	40	3.5
October	1188	452	38.0	546	46.0	132	11.1	58	4.9
November	1169	533	45.6	508	45.3	88	7.5	40	3.4
December	1212	547	45.1	513	42.3	108	8.9	44	3.6
TOTAL	14,282	7,093	49.6	5,661	39.6	1,148	8.0	388	2.7

<500,000	7,093	(49.6%)
500,000 to 1m	5,661	(39.6%)
1.0 to 1.4m	1,148	(8.0%)
1.5m or more	388	(2.7%)

TABLE 3

MEAN CELL COUNTS ON

HERD BULK MILK - COULTER COUNTER
(counts per ml)

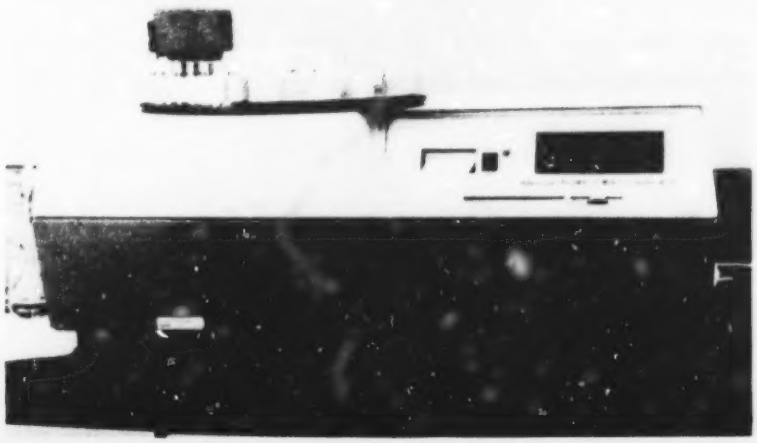
MONTH	1978	1979	1980	1981	1982	1983
January	745,000	684,000	738,000	744,000	544,000	572,000
February	745,000	600,000	720,000	814,000	579,000	532,000
March	758,000	647,000	744,000	696,000	625,000	477,000
April	672,000	622,000	781,000	629,000	542,000	550,000
May	705,000	600,000	805,000	612,000	688,000	503,000
June	699,000	660,000	750,000	626,000	620,000	522,000
July	769,000	724,000	840,000	622,000	625,000	632,000
August	765,000	842,000	970,000	561,000	718,000	700,000
September	684,000	899,000	828,000	571,000	658,000	641,000
October	715,000	777,000	757,000	520,000	689,000	691,000
November	751,000	811,000	735,000	510,000	634,000	618,000
December	760,000	766,000	718,000	540,000	594,000	638,000
AVERAGE	741,000	748,000	778,000	629,000	625,000	576,000

ANTIBIOTIC TESTING PROGRAM

In all milk markets the presence of detectable amounts of antibiotics in the milk supply is of concern for two reasons: (1) Presence of many types of antibiotics in milk, may cause an allergic reaction in persons who are sensitive to them; (2) The presence of small amounts of antibiotics alows or stops the growth of the bacterial culture used in the milk for cultured products and cheese, resulting in loss of production and "dumping" of the milk.

The Dairy Laboratory monitors all shipper samples once per month using Bacillus subtilis disc assay, ½" disc, in addition to checking all tank truck samples using Bacillus stearothermophilus. When a shipper sample is found to be "positive" for antibiotics, the producer, farm services inspector and hauler are notified for corrective action. As a result the producer receives a penalty deduction from the Milk Marketing Board. Also, shipments from the producer are not resumed until a negative test is obtained.

ADDED WATER TESTING PROGRAM



4C11 CRYOSCOPE
for detection of added water in milk. Operates automatically including printouts of freezing points.

All milk producer and truck samples are monitored at least once per month. When a reading of -0.524^{o} or higher is obtained on a producer sample it is considered to be adulterated. The Marketing Board is notified and that shipment is paid for at a reduced price.

TABLE 4

ANTIBIOTIC TESTING PROGRAM - 1983

MONTH	PRODUCERS TESTED	TOTAL TESTS DONE	PRODUCERS POSITIVE	PERCENT OF PRODUCERS IN PENALTY
January	1,220	2,053	7	.57%
February	1,341	2,044	10	.75%
March	1,220	2,044	2	.16%
April	1,217	2,120	4	.32%
May	1,217	2,117	4	.32%
June	1,217	2,193	4	.33%
July	1,214	1,951	6	.49%
August	1,204	2,102	7	.58%
September	1,198	1,981	2	.17%
October	1,194	1,896	5	.42%
November	1,190	1,752	1	.08%
December	1,189	1,879	6	.50%
TOTAL	14,621	24,132	58	

For the year there were .40% of the milk producers with positive antibiotics.

.28% of all samples tested were positive for antibiotics.

FINISHED PRODUCT TESTING

Bacteriological standards for processed and manufactured dairy products are set out by Regulation. These include Standard Plate Counts and Coliform counts on fluid milk products, Coliform and Staphylococcus counts on cheddar and specialty cheese products. Butter is tested for yeast and mould counts and proteolytic bacteria counts.

The standard for non-cultured fluid milk products is "not more than 10 Coliforms per ml. The standard for butter is "not more than 10 yeast and moulds per gram". Products exceeding the standards are retested and if found to exceed the standard, the product is subject to recall from the market.

Testing for various bacteria in pasteurized dairy products is done to determine potential sanitary problems at the dairy plant. High bacteria counts in the packaged product is largely due to post pasteurization contamination. In addition, all pasteurized dairy products are tested for adequate pasteurization by the use of the phosphatase test. Products which have not been heated to pastuerization temperature for sufficient time, or have been contaminated with small amounts of raw milk, will fail the test. If a product gives a positive test it is subject to immediate recall from the market.

The Standard Plate Count and Coliform count are used as a measure on pasteurized fluid products of the sanitary handling of the milk at the dairy plant. The types of bacteria found in pasteurized milk are predominately spoilage organisms and usually cause flavor defects. When there is a low bacteria count in the pasteurized milk usually it has a longer storage life and improved flavor and quality.

TABLE 5

FINISHED PRODUCT QUALITY - 1983

PRODUCT	COLIFORM COUNTS NUMBER OF TESTS	10/ml	%>10/ml	STANDARD PLATE COUNT NUMBER OF TESTS	20,000/ml	%>20,000/ml
Homo	703	7	1.0%	703	5	.7%
Low Fat Homo	554	3	.5%	552	1	.2%
Cereal Cream	500	6	1.2%	498	4	.8%
Whipping Cream	333	4	1.2%	334	4	1.2%
Chocolate Drink	323	4	1.2%	329	2	.6%
Skim Milk	518	10	1.9%	516	2	.4%
Ice Cream	232	20	8.6%	229	7	3.1%
Ice Cream Mix	276	14	5.1%	272	13	4.8%
Cottage Cheese	136	8	5.9%			
Buttermilk	182	4	2.2%			
Salad Cream	215	12	5.6%			
TOTAL	3,972	92	2.3%	3,433	38	1.1%

KEEPING QUALITY TESTS

This program was continued in 1983 with 184 Homogenized Milk and 191 Low Fat 2% samples tested.

Many flavor defects in pasteurized products are due to bacterial growth during storage. Routine bacteria counts are done on freshly pastuerized product picked up at the Dairy Plant and are very low (less than 300 per ml), however the maximum standard is 20,000/ml. These same samples, when held for 5 days at 7°C and then tested, may still have a low count or may have increased to 250,000 per ml or more. The bacteria count after storage is from bacteria which can grow at low temperatures and is indicative of the degree of contamination of the pasteurized product by psychrotrophic bacteria. If a processing plant produces low counts after storage (5 days at 7°C), shelf life and flavor quality is likely to be improved. The basis of the test is to detect potential spoilage bacteria which will shorten the shelf life of the pasteurized product. Note Table 6, 1.6% of the fresh samples tested were over 20,000 standard plate counts while 36.5 of samples tested after storage for 5 days at 7°C had counts of over 250,000 per ml.

CRYOSCOPE ON PASTEURIZED PRODUCTS

Under the Dairy Act, milk is considered adulterated if by test it is determined that there is "added water" in the product. The degree of adulteration is determined by measuring the freezing point of the milk, similar to the test used on raw milk. A freezing point of -0.524° or higher is considered to be adulterated and such products are subject to recall. Pasteurized products regularly tested are Homogenized milk, Low Fat Homo, and Skim Milk.

TABLE 6

KEEPING QUALITY TESTS 1983
(5 days @ 7°C then SPC)

PRODUCT	TOTAL	≤50,000/ml	51 - 100,000/ml	101 - 250,000/ml	>250,000/ml
Homo	184	97 (52.7%)	9 (4.9%)	8 (4.3%)	70 (38.0%)
Low Fat Homo	191	91 (47.6%)	16 (8.4%)	17 (8.9%)	67 (35.1%)

Initial tests on all samples were less than 20,000 except for 1 sample of 2% milk and 5 samples of Homo milk.

PHOSPHATASE TESTING

Products Tested: Homo, 2%, Skim, Cereal Cream, Whipping Cream, Ice Cream Mix, and Cottage Cheese

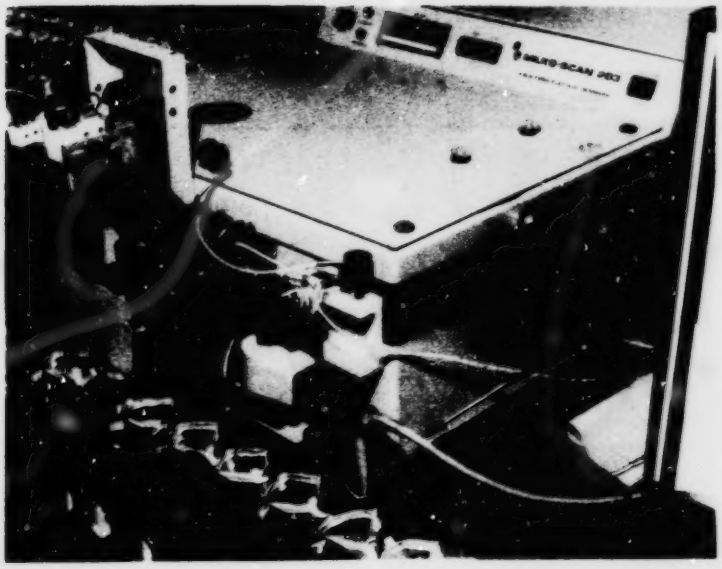
Total Number of Tests: 2,605 All phosphatase tests less than 2.3 units

The phosphatase test is used to determine if a product has been properly pasteurized or if the pasteurized product has been recontaminated with raw product. The test measures residual phenol in the sample. Raw milk gives a high phenol reading while a pasteurized sample will give values of less than 2 ug of phenol equivalent per 0.5 ml of fluid dairy product; or for cheese, a reading of less than 2 ug of phenol equivalent per 0.25 gm. Results showing more than 2 ug are reported as positive phosphatase.

TABLE 7

CRYOSCOPE - RAW MILK - 1983

MONTH	PRODUCER SAMPLES	-0.524° OR HIGHER	PERCENT		NORMAL	PERCENT			TRUCK SAMPLES	-0.524° OR HIGHER	PERCENT	TOTAL CRYOSCOPES
January	1,261	9	.74		1,252	99.3			125	0	0	1,482
February	1,213	2	.16		1,211	99.8			119	0	0	1,505
March	1,237	2	.16		1,234	99.8			127	0	0	1,511
April	1,243	5	.40		1,235	99.4			138	0	0	1,486
May	1,265	3	.24		1,261	99.7			133	0	0	1,603
June	1,347	4	.33		1,340	99.5			128	0	0	1,656
July	1,220	5	.41		1,214	99.5			129	0	0	1,497
August	1,204	10	.83		1,193	99.1			125	0	0	1,534
September	1,258	4	.33		1,252	99.5			126	0	0	1,494
October	1,244	7	.56		1,236	99.4			129	0	0	1,489
November	862	6	.70		851	98.7			121	0	0	1,101
December	1,237	5	.40		1,224	98.9			125	0	0	1,437
TOTAL	14,591	62	.42		14,503	99.4			1,525	0	0	17,795



MILKO SCAN 203

Tests for fat, protein and lactose by infrared. This equipment can test up to 220 samples per hour.

Butterfat, protein and lactose is determined on raw milk samples for the Dairy Herd Improvement Association, Owner Sampler programs and the Manitoba Milk Producers' Marketing Board. The Manitoba Milk Producers' Marketing Board use the butterfat tests as a basis of payment with protein and lactose results being stored for future use. Table 12 gives a summary of the average monthly fat tests for 1982 and 1983. The average protein tests are included for the same period. Table 13 gives average lactose comparisons for 1982 and 1983.

Butterfat testing of pasteurized dairy products is done to determine if each product meets the legal standard for butterfat. The minimum butterfat content for each product is stated on the container. Dairy products are subject to recall by the dairy plant if three consecutive tests are outside the acceptable limit.

Hewlett Packard 85 Controller

TABLE 8

CRYOSCOPE - PASTEURIZED MILK - 1983

MONTH	TOTAL	FREEZING POINT -0.524° OR HIGHER		PERCENT -0.524° OR HIGHER
January	96	0		0
February	112	0		0
March	147	0		0
April	105	1		.9
May	200	0		0
June	181	2		1.1
July	148	2		1.4
August	154	4		2.6
September	109	1		.9
October	116	2		1.7
November	118	1		.8
December	75	1		1.3
TOTAL	1,561	14	AVERAGE	.9%

TABLE 9

TESTS PERFORMED IN MILK COMPOSITION LAB. FOR THE YEAR 1983

MONTH	BUTTERFAT ON FARM TANK SAMPLES	BUTTERFAT ON DHIA	BUTTERFAT ON O/S	TOTAL PROTEINS & LACTOSE
January	5,592	8,691	2,703	16,9[illegible]
February	5,418	8,331	2,420	16,169
March	5,741	10,076	3,707	19,524
April	4,501	8,270	2,937	15,708
May	6,067	8,750	2,905	17,722
June	4,600	9,660	3,192	17,452
July	4,945	6,647	2,862	14,554
August	5,015	8,268	2,620	15,921
September	4,969	9,500	2,588	17,057
October	5,368	10,521	2,739	18,628
November	6,014	10,976	2,831	19,821
December	4,279	8,756	3,072	16,107
TOTAL	62,509	109,446	34,576	205,649

In addition to the regular compositional tests on Producer and DHIA samples, samples were also tested for the University of Manitoba Animal Science Department, Calibration Samples, Specials for commercial dairies and Farm Services, and inter-laboratory comparisons as follows:

JANUARY	567
FEBRUARY	416
MARCH	518
APRIL	341
MAY	874
JUNE	1,604
JULY	1,532
AUGUST	1,449
SEPTEMBER	1,332
OCTOBER	1,093
NOVEMBER	1,102
DECEMBER	1,004
TOTAL	11,832

Split samples were prepared and tested by the AOAC Mojonnier method and on both Milko Scan 203 machines. The numbers were as follows:

JANUARY	142
FEBRUARY	132
MARCH	176
APRIL	128
MAY	152
JUNE	144
JULY	143
AUGUST	182
SEPTEMBER	168
OCTOBER	160
NOVEMBER	156
DECEMBER	56
TOTAL	1,739

TABLE 10

BUTTERFAT TESTS ON FINISHED PRODUCTS

MONTH	TOTAL TESTS	OUTSIDE STANDARD		PERCENT OUTSIDE STANDARD
January	227	21		9.3
February	224	16		7.1
March	294	21		7.1
April	235	23		9.8
May	327	40		12.2
June	338	42		12.4
July	284	39		13.7
August	332	42		12.7
September	259	29		11.2
October	251	11		4.4
November	268	19		7.1
December	120	8		6.7
TOTAL	3159	311	AVERAGE	9.8

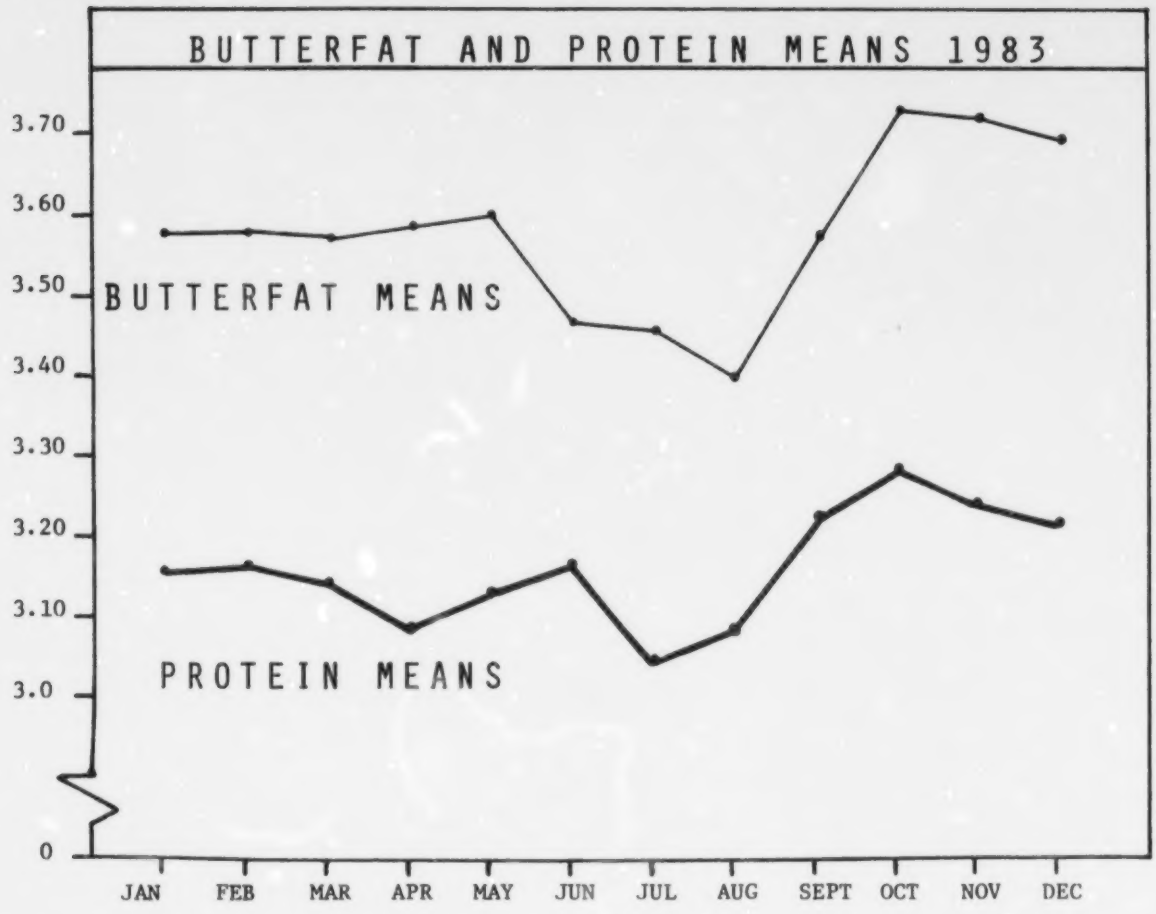
TABLE 11

TOTAL COUNTS ON RAW MILK HELD AT

MANITOBA PROCESSING PLANTS

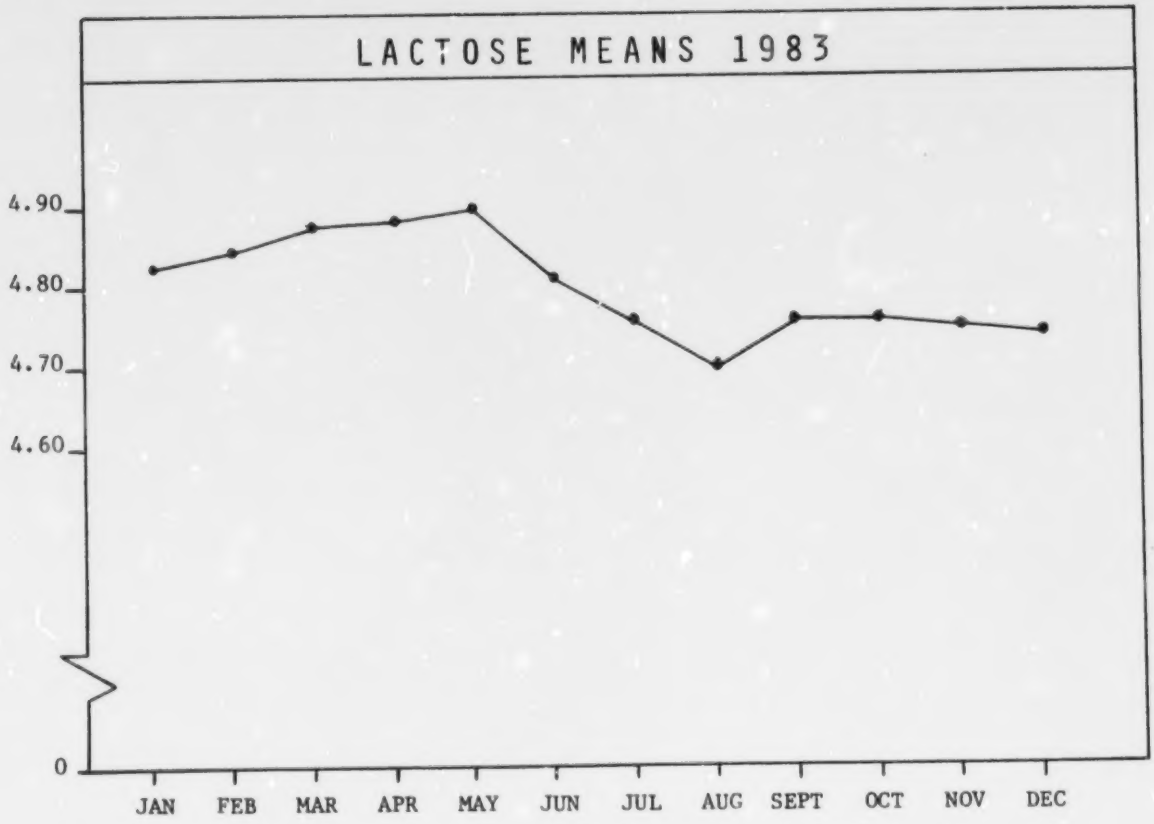
MONTH	1983 SAMPLES TESTED	NUMBER OVER 300,000		PERCENT OVER 300,000
January	38	14		36.8
February	42	7		16.7
March	49	17		34.7
April	40	11		27.5
May	41	21		51.2
June	40	21		52.5
July	28	10		35.7
August	12	4		33.3
September	24	3		12.5
October	26	5		19.2
November	55	12		21.8
December	34	11		32.4
TOTAL	429	146	AVERAGE	34%

TABLE 12



	1982		1983	
	B.F.	Protein	B.F.	Protein
Jan.	3.58	3.16	3.57	3.16
Feb.	3.58	3.16	3.57	3.17
Mar.	3.53	3.09	3.56	3.14
Apr.	3.53	3.07	3.58	3.09
May	3.49	3.05	3.59	3.13
June	3.46	3.16	3.47	3.17
July	3.44	3.07	3.46	3.05
Aug.	3.46	3.16	3.40	3.09
Sept.	3.58	3.25	3.58	3.24
Oct.	3.70	3.25	3.73	3.30
Nov.	3.64	3.22	3.72	3.26
Dec.	3.62	3.19	3.68	3.23

TABLE 13



	1982	1983
Jan.	4.67	4.83
Feb.	4.74	4.85
Mar.	4.74	4.87
Apr.	4.79	4.88
May	4.81	4.90
June	4.86	4.81
July	4.71	4.76
August	4.69	4.70
Sept.	4.69	4.76
Oct.	4.74	4.76
Nov.	4.73	4.75
Dec.	4.76	4.74